MEETINGS

Developing an Updated, Integrated Understanding of Mars

The Eighth International Conference on Mars; Pasadena, California, 14–18 July 2014

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More than 650 scientists from 21 countries gathered in mid-July at the California Institute of Technology (Caltech) to debate and examine the status of our exploration of the Red Planet. Since the Seventh International Conference on Mars in 2007, seven Mars missions—Mars Odyssey, Mars Exploration Rovers (Spirit/Opportunity), Mars Express, Mars Reconnaissance Orbiter, Phoenix, and Mars Science Laboratory (Curiosity)—have been returning data, augmented by telescopic observations, studies of Martian meteorites, laboratory work, and modeling studies.

The Eighth International Conference on Mars, sponsored by the Jet Propulsion Laboratory (JPL), Caltech, and NASA, brought together geoscientists, atmospheric scientists, astrobiologists, and engineers to present their latest discoveries and discuss the implications for understanding Mars. The goal of the meeting was to refocus the primary scientific questions surrounding Mars by identifying new paradigms and the most important unknowns.

Participants submitted 499 abstracts, many of which were presented during the morning sessions. These big-picture, thematic sessions aimed to foster cross-disciplinary discourse. The afternoon sessions centered on poster presentations—about 100 each day. The conference ended with a discussion moderated by Lisa Pratt (Indiana University) and led by a panel representing broad disciplines in Mars studies: Phil Christensen (geology, Arizona State University), Rich Zurek (climate, JPL), Dave Des Marais (life, JPL), and Marcello Coradini (human exploration, JPL).

Some highlights of the meeting follow.

- The emergence of Mars system science was apparent: Conference participants repeatedly discussed two key discoveries —mineral distribution and diversity, and large magnitude, obliquity-driven climate variations—that have profound implications for understanding the Martian geologic record, climate, and habitability.
- Evidence for geographically widespread liquid water on past Mars—and possibly ephemeral water present-day—is now unambiguous. This evidence, with detection of key elements and energy sources, indicates that early Mars was habitable. But did life develop? Important unknowns are liquid water's persistence and the environmental setting implicated by the mineral and chemical record. New means of determining process timing and duration estimates and petrology are required to understand the rock record. A frequent question from climate scientists dealing with a less luminous young Sun was, Did it have to rain to generate the landform and mineral records from that era? Scientists continue to debate whether early Mars was cold, with snow, ice caps, and transient water, or warm, with an integrated hydrologic system and standing bodies of water.
- Mars today has active processes involving dust, water, and atmospheric gases, which together with geological and chemical evidence (e.g., minerals and isotopes) are providing windows into the past, while challenging the physical processes and scales resolvable in current Mars climate models. Understanding modern Mars and its resources is also important for preparing for human exploration missions.

The conference was funded by NASA, and program logistics assistance was provided by the Lunar and Planetary Institute. Key presentations, including thematic session and integrative overviews, all abstracts, and many ePosters are available at http://bit.ly/8thMars2014. Also included are snapshots of the missions arriving at Mars (MAVEN, ISRO's Mars Orbiter Mission) and those under development (ESA's 2016/2018 ExoMars, 2016 InSight lander, 2020 Mars Rover). In addition to the authors/conveners listed, conveners Rich Zurek and Dan McCleese and organizer Serina Diniega (JPL) were instrumental in the setup of the conference and in writing this summary.

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